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ABSTRACT

A study investigated the impact of direct instruction on reading comprehension strategies and the degree to which cooperative learning processes enhance students' learning of strategies. Subjects, 486 third- and fourth-grade students in four elementary schools from an ethnically diverse school district in a medium-sized city in central Pennsylvania, were assigned to instructional treatments on strategies for identifying the main idea of passages. Treatments involved cooperative learning with direct instruction, direct instruction alone, and a traditionally instructed control group. Both groups who received direct instruction on main idea strategies performed significantly better than did the control students in identifying main ideas of passages. Students who also used cooperative learning processes to summarize and explain the strategies to one another performed significantly better than did the students who received only direct instruction on the strategies. (Three tables of data are included; 38 references are attached.) (Author/RS)

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Report No. 44

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THE EFFECTS OF COOPERATIVE LEARNING AND DIRECT INSTRUCTION IN READING COMPREHENSION STRATEGIES ON MAIN IDEA IDENTIFICATION

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This program focuses on improving the organizational performance of schools in adopting and adapting innovations and developing school capacity for change.

This report, prepared by the Elementary Schools Program, examines the effects of direct instruction on reading comprehension strategies and the effects when both direct instruction and cooperative learning are used.

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Abstract

An experimental study was conducted to investigate the impact of direct instruction on reading comprehension strategies, and the degree to which cooperative learning processes enhance students' learning of strategies. Students were assigned to instructional treatments on strategies for identifying the main idea of passages. Treatments involved cooperative learning with direct instruction, direct instruction alone, and traditional instruction control. Both groups who received direct instruction on main idea strategies performed significantly better than control students in identifying main ideas of passages. Students who also used cooperative learning processes to summarize and explain the strategies to one another performed significantly better than students who received only direct instruction on the strategies.

Introduction

Learning to read is one of the most important things children accomplish in elementary school, as it is the foundation for most of their future academic endeavors. From the middle elementary years through the rest of their lives as students, children spend much of their time reading and learning information presented in text. The activity of reading to learn requires students to comprehend and recall the main ideas or themes presented in expository text. Yet, until recently, reading instruction has overemphasized instruction and practice on literal comprehension, such as answering detail questions, (Guszak, 1967; Hansen, 1981), and has lacked explicit instruction on non-literal comprehension skills, such as the teacher explaining how to determine the main idea of a paragraph (Durkin, 1978-79; 1981).

In the last ten years, reading research has made a significant impact on comprehension instruction, especially in two areas: cognitive psychology and classroom organization. Research in cognitive psychology has led to a better understanding of the comprehension strategies used by successful readers and how they control and monitor their use of strategies (Baker & Brown, 1984; Spiro, Bruce & Brewer, 1980). This has led to more explicit instructional content for use in initial reading instruction and in remediating comprehension deficiencies. Research on classroom organization has focused on the quality of methods of instruction. Specifically, research on cooperative learning has developed more effective and efficient instruction (Slavin, 1983a, c; Stevens, Madden, Slavin, & Farnish, 1987), as well as instruction which is more in tune with the developmental level and motivation of the students.

This paper examines the combination of both of these areas of research on teaching students a specific comprehension skill, the identification of the main idea of a paragraph. The study investigates the impact of direct instruction on main idea comprehension strategies and the degree to which cooperative learning processes enhance the effect.

Direct Instruction on Comprehension Strategies

Recent research in cognitive psychology has described specific strategies children use in comprehending text and metacomprehension strategies that they use to monitor and evaluate their comprehension. Research in reading instruction has focused on providing students with direct instruction on specific comprehension and metacomprehension strategies to improve their reading ability. Brown and Palincsar (1982) have shown that direct instruction involving three strategies is particularly effective: instruction in comprehension fostering strategies, instruction on the importance and usefulness of the strategies, and metacognitive monitoring strategies to check the appropriateness of strategy use.

This type of direct instruction on strategies has been applied successfully in a number of studies on a variety of comprehension skills (e.g. Baumann, 1984; Brown & Palincsar, 1982; Day, 1980; Dewitz, Carr, & Patberg, 1987; Paris, Cross & Lipson, 1984; Raphael & Wonnacott, 1985: Stevens, 1988). Day (1980), for example, found that students who received instruction that integrated self-management strategies with strategies for writing summaries exhibited greater accuracy in their summaries than did students who were trained in either self-management or summarization strategies alone. This indicates the importance of the metacognitive component in strategic instruction. More effective training includes teaching students self-regulation skills that enhance their ability to monitor their own cognitive activities (Brown, Campione & Day, 1981).

Paris and his associates investigated the effects of "informed strategy training" to increase students' awareness of the importance of using general strategies and metacomprehension skills in reading (Paris, Cross & Lipson, 1984; Paris & Jacobs, 1984). In informed strategy training, students are taught general approaches to checking their comprehension, recognizing problems, and using strategies to resolve the problem. An important aspect of the training is explaining the rationale behind and the usefulness of the comprehension and metacomprehension strategies in which the students are being trained. Paris and Jacobs (1984) found that students who received

the informed strategy training were more aware of using comprehension strategies and the importance of using them. Also, students with higher strategy awareness performed better on comprehension measures requiring the use of metacognitive skills, such as cloze passages and error detection measures. Thus, instruction on comprehension and metacomprehension strategies which includes increasing students' awareness of the importance of strategies seems to promote independent and self-controlled use of the strategies (Paris, et. al., 1984).

Providing students with direct instruction on comprehension strategies and metacognitive skills is an effective way to teach comprehension, but in a traditionally organized classroom, this accounts for a minority of the allocated time in reading. An almost universal feature of elementary reading instruction is the use of reading groups of students of similar ability (see Hiebert, 1983). The major reason for the use of ability groups in reading is that students need to have materials appropriate to their levels of skill. However, use of reading groups creates a problem; when the teacher is working with one reading group, the other students in the class must be occupied with activities they can complete with minimal teacher direction.

Research on these "follow-up" activities, or unsupervised seatwork, indicates that they are often of poor quality, are rarely taken seriously by teachers or students, are poorly integrated with other reading activities (e.g., Beck, McKeown, McCaslin, & Burkes, 1979; Osborn, 1984), and that students time on-task during follow-up periods is typically low (e.g., Anderson, Brubaker, Alleman-Brooks, & Duffy, 1985). Yet in a class with three reading groups, as much as two-thirds of the reading period is spent on follow-up activities. Research on cooperative learning classroom organization has developed instructional strategies that not only motivate students to remain on task and improve the management of follow-up activities, but also encourage and support instructionally relevant dialogue between classmates on learning tasks (Slavin, 1983a, 1987).

Cooperative Learning

Over the past fifteen years, a substantial body of research at various grade levels and in numerous content areas has documented the effectiveness of cooperative learning methods. Generally these techniques use a task structure which requires students to work cooperatively in four- to six-member groups of heterogeneous ability. The cooperative tasks can range from group activity focused on solving common problems to individual learning of specific skills or content. Cooperative learning methods also involve incentives for cooperation, such as group rewards or recognition based on the group's academic performance. In most cases, cooperative learning also includes structured instruction, often with teacher-led instruction preceding the cooperative learning activities, and with evaluation and feedback following.

Field experiments of four to thirty weeks duration have consistently shown that cooperative learning methods produce greater academic achievement than does traditional instruction (Sharan, 1980; Slavin, 1980; 1983a, b). Similarly, cooperative learning methods also result in more positive attitudes toward school, improved student self-esteem, and improved relations among different types of students (Sharan, 1980; Slavin, 1983a, c).

In an attempt to understand why cooperative learning works and which of the basic components help produce its effects, researchers have investigated different approaches to cooperative task structures and group rewards. In general, two characteristics are found to be common to effective cooperative learning models: incentives to cooperate and individual accountability.

Giving students incentives to work together cooperatively, such as rewarding students for the performance of the entire group, promotes cooperation and on-task behavior (Slavin, 1983a, c; Webb, 1982). When students are given clear incentives for doing well as a group, and when tasks facilitate cooperation, students exhibit cooperative task-oriented behavior in learning groups.

But incentives alone are not sufficient to increase student achievement; cooperative learning methods are most effective instructionally when there is also individual accountability (Slavin, 1983a, c). Models which are most effective in terms of academic achievement are those in which the group's success depends on the performance of each and every student in the group. Combining these two critical ingredients - incentives to cooperate and individual accountability - seems to produce the most instructionally effective model of cooperative learning. Giving group rewards contingent upon the sum of each group member's performance promotes both cooperation and improved academic performance of every student (Slavin, 1983a).

Developmental psychologists have also examined the importance of cooperative learning or collaboration, particularly for higher cognitive processes (Brown & Palincsar, 1986; Vygotsky, 1978). In particular, peer collaboration is effective for mastering cognitive functions which are undergoing development but not yet mastered, or functions within the learner's proximal zone of development (Vygotsky, 1978). Vygotsky described effective instruction as preceding development, and focusing on cognitive functions within the zone of proximal development and in the process of being mastered. Collaborative activity between students of the same age is most likely to be within students' zone of proximal development, and it requires that students reflect upon their knowledge to make generalizations and elaborations which they can convey to their peers. To make generalizations and elaborations, students need to understand the cognitive relations of the new knowledge and to relate it to their prior knowledge, which is an effective way to improve depth of processing (Wittrock, 1986).

Research on cooperative learning has shown that students who give and receive elaborate explanations learn better than those who simply receive the correct answers from their peers (Peterson & Janicki, 1979; Webb, 1982). However, simply encouraging students to cooperate on academic tasks does not assure that they will engage in elaborative explanations which lead to increased learning (Slavin, 1983c, 1987). Students need to be motivated to collaborate effectively when working cooperatively, and to ensure learning by all students, every student must be

held accountable for learning the new skills.

Integration of Cooperative Learning and Direct Instruction

Cooperative learning and direct instruction have been integrated in a number of cooperative learning programs developed at Johns Hopkins University (Slavin, 1986). Each of these programs uses a similar cycle of instruction:

Teacher-directed instruction. Initial instruction always comes from the teacher via explicit explanation of new skills or processes, models and examples.

Team practice. Students work in four- or five-member heterogeneous-ability learning teams to practice the material presented by the teacher, using worksheets or other follow-up materials. Depending on the content, student's activities will include doing practice exercises independently and checking each other, drilling each other on a list, discussing answers and reaching a consensus, and so on. Teammates also assess each other to ensure each team member's success on the individual assessments.

Individual assessments. Students are individually assessed on their learning of the skills or content presented in the lesson and practiced in the follow-up activity.

Team recognition. Students' scores on the individual assessments are combined to form team scores, with each team member having an equal ability to contribute. Teams that meet pre-established criteria earn certificates or other rewards in recognition of their performance.

This basic cycle of activities gives students an incentive to do a good job helping their teammates learn. Because the team can succeed only if each individual team member has learned the material, students must take responsibility for one another's achievement as well as their own. If students provide one another with elaborated explanations of concepts or skills, they gain in achievement (Dansereau, 1985; Webb, 1982). The elements of the cooperative learning cycle are intended to motivate students to provide such elaborated explanations and

other assistance. Several component analyses of cooperative learning, as well as comparisons of instructionally effective and less effective forms of cooperative learning, have established that all of the elements of the cycle outlined above must be present if cooperative learning is to significantly increase student achievement (Slavin, 1983c).

Cooperative Integrated Reading and Composition Program (CIRC)

This cycle of instruction and cooperative learning processes has recently been applied to reading and writing instruction in the elementary grades, through the development of the Cooperative Integrated Reading and Composition (CIRC) program. A major focus of the CIRC program activities is on making more effective use of follow-up time. Students work within cooperative teams on prescribed activities in such areas as reading comprehension, vocabulary, decoding, and spelling that are coordinated with their reading group instruction and the stories in their basal readers. CIRC also provides explicit instruction in reading comprehension skills, and in writing and language arts skills integrated in a writing process approach to teaching writing. Students are motivated to work with one another on these activities by the use of a cooperative reward structure in which they may earn certificates or other recognition based on the learning of all team members (as described above). A brief description of these activities is provided below. (See Stevens, et. al., 1987 for a more detailed description.)

Basal-related activities. Students use their regular basal readers and receive instruction in their reading ability groups as determined by the teacher. During reading group instruction, the teacher introduces the new vocabulary words and their meanings, sets a purpose for reading, and discusses the story after the students have read it. Students then engage in follow-up activities which are related to the teacher-directed instruction and to the basal story.

During the follow-up time, the students work with their teammates to complete activities in which they:

a) read the story silently and orally;

b) discuss and answer questions about the story;

c) practice the new vocabulary in order to read it quickly and accurately;

d) practice writing meaningful sentences with the new vocabulary;

e) summarize major episodes of the story;

f) practice new spelling words; and

g) write a paragraph or a brief composition on a topic related to the story or on the student's reaction to the story.

For each of these activities, teammates work together by discussing the work, checking each other's work, and providing feedback to one another.

Direct instruction in reading comprehension. One day a week, students receive direct instruction on specific reading comprehension skills, such as identifying main ideas, drawing conclusions, and comparing and contrasting ideas presented in passages. A step-by-step curriculum was developed to provide instruction and practice on comprehension and metacognitive monitoring strategies. Following teacher-led instruction on a specific skill, students work both with their teammates and independently to complete follow-up activities related to that skill.

Integrated writing and language arts. The writing/language arts component focuses instruction and practice on writing, using a process approach. Students engage in planning, drafting, revising, editing, and "publishing" compositions. The teacher provides instruction in writing and language mechanics skills integrated with students' writing activities. Students work cooperatively to help and to give feedback to one another. The teacher also engages in conferences with students to provide further feedback and instruction based upon the student's written composition.

The results of three field experiments comparing CIRC to traditional instruction indicated significantly higher achievement on reading and language arts standardized tests and on writing

samples for students in CIRC classes (Stevens, et. al., 1987; Stevens, Slavin, & Farnish, 1989). However, the complexity of the program makes it impossible to determine the relative impact of the program's components, the cooperative learning processes, or the curriculum in the overall effect of CIRC.

To remedy this problem, Slavin (1984) has suggested component analysis in which major components of a complex program would be pulled out and studied separately and in conjunction with other elements of the program. For example, a program that involves a new curriculum and an innovative instructional process would investigate the impact of the instructional process both when teachers use the curriculum and when they don't, compared to a traditional instruction control. The results of such a component analysis would provide a reasonably good idea of the relative effects of the curriculum and process components. Such information would provide valuable knowledge about effective processes which may be generalizable to new instructional content or settings.

To better understand the impact of cooperative learning processes used in conjunction with direct instruction, it is necessary to disassemble them in component analyses. The goal of this study is to investigate the impact of cooperative learning classroom organization on direct instruction in reading comprehension skills.

Method

Subjects and Design

The subjects were 486 third- and fourth-grade students in four elementary schools from an ethnically diverse (see Table 1) school district in a medium-sized city in central Pennsylvania. The students were from thirty classes that were randomly assigned to one of three treatment groups, counter-balanced for grade level. All of the teachers were volunteers, and teachers were

promised training and materials for the reading comprehension part of the CIRC program after the conclusion of the intervention. The treatment lasted for four weeks in the Fall of 1986. Each of the teachers allocated the same amount of time for reading, an hour and a half in third grade and an hour in fourth grade.

Insert Table 1 about here

Treatments

The experimental treatments in this study focused instruction on the comprehension of main ideas of passages. The ability to recognize the main idea, or thematic elements, of a passage is critical for the comprehension of a passage (see Rumelhart, 1977; van Dijk and Kintsch, 1978). Yet many students, particularly less-skilled readers, lack proficiency in identifying main ideas of text (Brown and Campione, 1977; Thorndyke, 1977). Identifying main ideas was selected as the focus for this study because it is a critical and central skill for comprehension. For the purposes of this study, the main idea of a passage was defined as a relatively brief, one-sentence summary of the information presented in a majority of the propositions in the passage, excluding trivial or redundant information.

Direct Instruction with Cooperative Learning (CL). The direct instruction with cooperative learning treatment group spent approximately half of their reading time four days a week using CIRC materials on main idea comprehension. Teachers taught comprehension strategies and metacomprehension skills as detailed in the teacher's instructions of the CIRC curriculum materials. Following instruction, the students used cooperative learning processes, known as team practice, to complete the follow-up activities. During team practice the teammates worked together on follow-up exercises, discussing the exercises and arriving at a consensus answer.

Teachers monitored students during team practice, checking the teams' answers and providing additional instruction if necessary.

When the teams were consistently answering the questions accurately, the students moved on to independent practice, in which they completed follow-up activities independently. After completing one section (usually 6-8 exercises), the students exchanged papers with teammates for peer assessment. The teammates checked each other's answers and provided corrective feedback. As in the full CIRC model, if a student made one error, the student repeated the independent practice and peer assessment cycle. If the student made more than one error, the teacher was alerted and provided remediation prior to the student repeating the independent practice and peer assessment cycle. Students who made no errors went directly to the mastery test. The tests were scored by the teacher, and test scores were used to determine team scores. Teams received awards based upon their team scores, as compared to fixed standards, as in the full CIRC program.

The rest of the reading instructional time was spent reading basal readers and doing basal-related follow-up activities. Teachers provided no explicit instruction on comprehension skills other than those in the CIRC materials.

Direct Instruction in Reading Comprehension (*DI*). Just as in the CL group, students in this treatment group spent approximately half of their reading instructional time four days a week using CIRC reading comprehension materials related to main idea skills (e.g. identifying the topic of a paragraph, identifying the main idea of a paragraph). In this treatment, the teachers provided direct instruction on comprehension strategies and metacomprehension skills as detailed in the teacher's instructions. The teacher presented the instruction to the whole class. Following instruction, the students used the CIRC worksheets as follow-up materials related to the instruction. The students worked independently to complete the follow-up activities, and the teachers periodically monitored their work. After the students completed the practice activities, the teacher gave the students the test related to the specific skill.

The rest of the reading instructional time was spent reading stories in the basal reader, and doing follow-up activities related to the story (e.g. answering story-related questions). As in the CL group, teachers provided no explicit instruction on comprehension skills other than that involved in the CIRC materials.

Control. The control teachers used their traditional methods and curriculum materials. In reading, this involved using a basal reading series in two or three reading groups, with related workbook and worksheet activities used during follow-up time.

Materials

All three treatment groups used the same basal reading series as part of their regular reading instruction. The CL and DI treatments used the CIRC curriculum materials to provide instruction on main idea comprehension.

Measures

Pretests. A 30-item multiple-choice pretest was used to measure students' entering abilities. The test was made up of ten paragraphs, and each paragraph was followed by a detail question, a main idea question, and an inference question about the paragraph. The detail questions were textually explicit and the inference questions were scriptually implicit, as described by Pearson and Johnson (1978). The main idea questions simply asked the students to identify the main idea of the passage.

Posttests. A 20-item multiple-choice test was used as the dependent measure. The test was made up of ten paragraphs, and each paragraph was followed by a main idea question and an inference question. The main idea questions were used to measure the effectiveness of the various treatments for teaching the students how to identify the main idea of paragraphs. The inference questions were used to determine if this training generalized to a different reading comprehension skill.

Reliability. The reliability of the experimenter-designed tests was determined by using a randomly-selected subsample of 90 students, three students per class. The internal consistencies (alpha coefficients) of the 10-item subtests on the pretest were .71 for details, .71 for main ideas, and .62 for inferences. For the posttest, the alpha coefficients for the 10-item subtests were .80 for main ideas and .77 for inferences.

Procedure

The teachers began their intervention on the first instructional day after the pretest. For four days each week, the teachers in the experimental groups spent approximately half of their reading time on main idea instruction as per their treatment condition. The control teachers continued their traditional instruction. In four weeks, the teachers completed their interventions, and the posttests were administered.

Results

Implementation

Implementation checks conducted during the study indicated that the teachers implemented the critical components of their particular treatments. In the DI group, the teachers faithfully implemented direct instruction on main idea skills in reading groups, as prescribed in the curriculum materials. Teacher instruction was followed by students independently practicing the skills at their seats. In the CL group, teachers similarly provided direct instruction using the curriculum materials. This was followed by students' cooperative practice during initial practice activities. Following the cooperative practice, students practiced independently and checked each other's answers.

Analyses

The results of the experimenter-designed posttests were analyzed by first adjusting for pretest measures of the related subtest and the pretest measures for detail questions. For example, the main idea posttest scores were adjusted for pretest scores on detail and main idea questions. The pretest scores for detail questions were used in the adjustment to control for the significant initial differences between the treatment groups on this measure. The main idea questions premeasure or the inference questions premeasure were also used in the adjustment to control for students entering ability on those specific skills and to increase the power of the analyses. The adjusted scores were used in a nested analysis of variance, which is essentially a class-level analysis (Glass & Stanley, 1970; Hopkins, 1982). The nested analyses tested the mean square for treatment against that for classes within treatments, with degrees of freedom associated with the number of classes.

Pretest

As described previously, teachers were randomly assigned to treatment groups. Individual-level analysis of variance found no significant differences among the treatment groups on main idea questions and on inference questions on the pretest ($p>.25$). However, there was a significant difference on the detail questions of the pretest {$F(2,27)=3.76$, $p<.05$, $MSe=6.52$}. This difference favored the control group (see Table 2).

Insert Table 2 about here

Analyses of students' prior reading achievement also indicated no significant differences between the treatment groups ($F<1.0$).

Posttest

Main Idea Questions. The class-level analysis indicated highly significant differences on the adjusted posttest scores for main idea questions {$F(2,27)=13.2$, $p<.001$, $MSe=9.08$}. The results and adjusted means are presented in Table 2. The Table also shows the effect sizes of the two experimental conditions as compared to the control (effect size is the difference between adjusted means divided by the unadjusted control group standard deviation). For the Direct Instruction (DI) group the effect size is .63, and for the Cooperative Learning (CL) group, the effect size is .88.

Multiple comparisons between adjusted treatment groups means were computed to determine the pattern of differences which resulted in a significant main effect. The means were compared using individual-level analyses to increase statistical power. Although this procedure may limit the generalizability of the findings it substantially reduces type II error, the probability of arriving at a false negative result. Also, because thirty teachers were randomly assigned to the three treatments and posttest scores were adjusted by pretest scores, the potential confounding of teacher effects with treatment effects in the individual-level analyses was decreased (see Cornfield & Tukey, 1956; Slavin, 1983b). Comparisons between the cell means used modified Bonferoni t-tests (Hays, 1981; Keppel, 1982) to adjust the family-wise significance level. Table 3 presents the comparisons between the adjusted group means. For main idea questions, both experimental group means are significantly greater than that of the control group. The adjusted mean for the CL group is also significantly greater than that of the DI treatment group.

Insert Table 3 about here

Inference Questions. The inference questions were used to measure the transfer of learning

to a different comprehension skill. The class-level analysis shown in Table 2 indicates a marginally significant main effect on adjusted posttest scores on inference questions {F(2,27)=2.82, p=.077, MSe=5.67}. The effect sizes relative to the control group (Table 2) are .23 for the DI treatment and .32 for the CL treatment.

Although the main effect did not reach a traditional level of significance, the magnitude of the effects warranted further analysis. The adjusted cell means were compared using a Bonferoni t-test as described above. The comparison (see Table 3) indicates a significant difference between the CL and control groups (t=2.90, p<.05) on the adjusted cell means for the posttest inference questions. All other comparisons were nonsignificant.

Discussion

The results of this study show the relative impact of direct instruction and cooperative learning in teaching students specific reading comprehension strategies. Clearly, direct instruction on comprehension strategies, a component of both experimental treatments, is an important aspect of effective teaching. In this study, direct instruction alone yielded significant and substantial effects on students' achievement. This evidence replicates similar findings in a number of previous studies (eg. Baumann, 1984; Brown & Palincsar, 1982; Dewitz, Carr & Patberg, 1987; Paris, et. al., 1984; Stevens, 1988). The results also support the process of informed strategy training for comprehension instruction, which includes comprehension fostering strategies, an awareness of the importance and usefulness of the strategies, and metacognitive strategies to monitor strategy use (Paris, et. al., 1984).

The addition of cooperative learning processes to direct instruction on reading strategies contributes significantly to their effectiveness, as evidenced by greater achievement by the CL group as compared to the DI group. When students are given a structured way to collaborate on

academic tasks, they engage in elaborate explanations of the academic process to one another (Peterson and Janicki, 1979; Webb, 1982). Providing explanations to a peer offers potential cognitive benefits because it requires the student to reflect upon the information or strategies learned, and to give explanations or generalizations about the knowledge, thus increasing the depth of processing of that information (Wittrock, 1986). In this study the students who received direct instruction and who engaged in collaborative dialogue in the cooperative learning treatment outperformed those who received direct instruction alone by one-fourth of a standard deviation. Thus giving and receiving elaborative explanations related to recently learned comprehension strategies has a measureable impact on students' learning.

Students were also given inference questions about paragraphs on the posttest as a measure of transfer of the treatment to a different kind of comprehension, one not directly related to the intervention. The analysis showed a marginally significant treatment effect -- students who received cooperative learning with direct instruction on main idea comprehension performed significantly better than the control group on inference questions. While these results are not robust, student performance in the cooperative learning group was nearly one-third of a standard deviation greater than that of the controls (E.S.=.31) on the inference questions. This effect along with the fact that the cooperative learning students also had superior performance on main idea questions suggests that being able to identify the main idea of a paragraph facilitates inferential comprehension. Making inferences about a paragraph requires the readers to integrate the information from the text with their own background knowledge. Deficient comprehension of text would seem to debilitate inferential comprehension. Perhaps this instructional intervention improved text comprehension to the degree that it removed that hurdle in inferential comprehension.

In terms of a science of instruction, this study shows that cooperative learning classroom organization and direct instruction in reading comprehension are complementary and their integration forms an effective and dynamic instructional process. The direct instruction

materials use the components of "informed training strategy" to provide effective, explicit instruction on specific comprehension skills. However, this resolves the instructional issues related to only one part of students' reading time - that which is led by the teacher.

In typical elementary classrooms, students spend one-half to one-third of their reading time doing seatwork activities. Seatwork, or follow-up time, usually is unsupervised by the teacher, and underutilized in terms of instructional impact (Anderson, et. al., 1985; Osborn, 1984). A major instructional advantage of cooperative learning is that it focuses in part on effectively using students' instructional time when they are not supervised by the teacher. During seatwork activities in cooperative learning, students work together to provide immediate feedback on questions, re-explain how to complete the seatwork assignment, and motivate each other to stay on task and do a good job completing the assignment (Slavin, 1983a, c). Thus, cooperative learning resolves some of the problems that typically produce lower on-task rates during unsupervised seatwork (Anderson, et. al., 1985; Osborn, 1984).

Strong support for an effective model of comprehension instruction is found in the results of the cooperative learning treatment in this study. Instruction which combines a cognitive approach to direct instruction, such as informed strategy training, combined with cooperative learning classroom processes, can be an effective method for teaching comprehension strategies.

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Table 1

Ethnicity of School Populations

Elementary School	Black	White	Hispanic	Other
School 1	85.0	10.0	3.8	1.2
School 2	60.1	27.6	12.0	.3
School 3	56.3	21.6	16.9	5.2
School 4	83.2	9.2	7.6	0.0

Table 2

Means, Standard Deviations, and Effect Sizes

Treatment:	CL		DI		Control	
	x	(SD)	x	(SD)	x	(SD)
Pretest (raw score)						
Detail Questions	6.58	(2.57)	6.92	(2.14)	7.13	(2.00)
Main Idea Questions	4.27	(2.22)	4.33	(2.24)	4.20	(1.94)
Inference Questions	4.02	(1.87)	4.28	(2.22)	4.11	(1.98)
Posttest (raw score)						
Main Idea Questions	6.41	(1.83)	6.02	(1.89)	4.77	(2.03)
Inference Questions	5.75	(2.14)	5.77	(2.19)	5.34	(2.08)
Adjusted Posttest						
Main Idea Questions	5.08	(1.73)	4.60	(1.86)	3.42	(1.88)
Inference Questions	2.86	(1.90)	2.71	(1.94)	2.26	(1.92)
N	153		166		167	
Reading Achievement (z scores)						
Pre-achievement (Spring 86)	.023	(1.01)	.064	(.92)	-.085	(1.06)
Post-achievement (Spring 87)	.032	(1.00)	.064	(.97)	-.093	(1.02)

Effect Size of Treatments Versus Control

Using Adjusted Posttest Scores

Posttest	CL	DI
Main Idea Questions	+.88	+.63
Inference Questions	+.31	+.23

Note: All pretests and posttests included 10 questions of each type. The adjusted posttests were controlled for initial differences on the detail questions premeasure and the premeasure of that type of question; main idea posttests were controlled for main idea premeasures, and inference posttests controlled for inference premeasures.

Table 3

Multiple Comparisons of Adjusted Group Means

Main Idea Posttest	df	t	Observed p	Effect Size
CL vs. DI	319	2.38 *	.035	+.26
CL vs. Control	320	8.19 **	.000	+.88
DI vs. Control	333	6.00 **	.000	+.63
Inference Posttest				
CL vs. DI	319	.69	.490	+.08
CL vs. Control	320	2.90 *	.004	+.31
DI vs. Control	333	2.20	.029	+.23

Significance levels: * = $p<.05$, ** = $p<.01$

Note: A modified Bonferoni adjustment was applied to the significance level to attain a family-wise alpha of .05.